What is claimed is:

1. A method of normalizing color information for normalizing a color space using a statistical process for each color name, said method being used for controlling a colorimetoric characterization of at least one of a source device and an output device, said method comprising the steps of:

(a) rendering a test color on at least one of the source device and the output device;

(b) watching the test color;

(c) naming the test color with a color name;

(d) grouping one of colorimetric values of the test color and a device drive level, both obtained in step (c), into each color name; and

(e) normalizing color spaces of each color name using a statistical process based on one of the colorimetric value and the device drive level grouped in step (d).

2. The method of normalizing color information as defined in Claim 1, wherein the statistical process in step (e) includes calculating a gravity vector and a variance covariance matrix from one of the colorimetric value and the device drive level, and normalizing the color space using the gravity vector and the variance covariance matrix.

3. The method of normalizing color information as defined in Claim 1 or Claim 2, wherein the naming uses a categorical basic color as the color name.

4. The method of normalizing color information as defined in Claim 3, wherein the categorical basic color includes one of red, brown, pink,

orange, yellow, green, blue, purple, white, gray and black.

5. The method of normalizing color information as defined in Claim 1 or Claim 2, wherein the naming is practiced by an viewer using a memorized color name through question and answer practice.

6. The method of normalizing color information as defined in Claim 1 or Claim 2, wherein the naming is practiced by an viewer using a color name set by the viewer through question and answer practice.

7. A method of exchanging color information for transmitting color information from a source device to an output device, said method comprising the steps of:

mapping a control point of the same color name disposed in a color space normalized by the method defined in Claim 1 or Claim 2; and

exchanging the color information between the source device and the output device.

8. The method of exchanging color information as defined in Claim 7, wherein the control point is a gravity vector calculated from one of the colorimetric value and the device drive level defined in Claim 2.

9. The method of exchanging color information as defined in Claim 7, wherein the control point is disposed one of on the source device, on a gamut surface of the output device and near to the gamut surface.

10. The method of exchanging color information as defined in Claim

7, wherein a part of the control point is a gravity vector calculated from the color information grouped based on a color naming by a viewer, and other control points than the part of the control point is disposed one of on the source device, on a gamut surface of the output device and near to the gamut surface.

11. The method of exchanging color information as defined in Claim 7, wherein the control point disposed in a color space of the source device agrees with that in a color space of the output device in terms of colorimetric value.

12. The method of exchanging color information as defined in Claim 7, wherein the control point disposed in a color space of the source device agrees with that in a color space of the output device in terms of color appearance.

13. The method of exchanging color information as defined in Claim 7, wherein a first control point, a part of the control point, disposed in a color space of the source device agrees in terms of colorimetric value with a second point, another part of the control point, disposed in a color space of the output device, and wherein other control point than the first control point disposed in the color space of the source device agrees in terms of color appearance with other control point than the second control point disposed in the color space of the output device.

14. The method of exchanging color information as defined in Claim 7, wherein a colorimetric distance between the control point disposed in a color space of the source device and the other control point disposed in a color space of the output device is minimized within an color reproduction range of both the devices.

15. The method of exchanging color information as defined in Claim 7, wherein difference in color appearance between the control point disposed in a color space of the source device and the other control point disposed in a color space of the output device is minimized within a color reproduction range of both the devices.

16. The method of exchanging color information as defined in Claim 7, wherein a colorimetric distance between a first control point, a part of the control point, disposed in a color space of the source device and a second control point, a part of the other control point, disposed in a color space of the output device is minimized within an color reproduction range of both the devices, and wherein difference in color appearance between other control point than the first control point of the control point disposed in a color space of the source device and other control point than the second control point of the other control point disposed in a color space of the output device is minimized within the color reproduction range of both the devices.

17. The method of exchanging color information as defined in Claim 12, 13, 15 or 16, wherein when a control point where the color appearances agree with each other is found or where the difference of color appearance is minimized is found, a color in a cusp of a gamut between the source device and the output device is shown to a viewer, and then a color the viewer specified is used as one of a gravity control point and a surface control point of the output device.

18. The method of exchanging color information as defined in Claim

7, wherein the mapping includes calculating a scaling coefficient which converts a distance between gravity vectors of the source device into that of the output device, and weighing the scaling coefficient responsive to a position of an input point for determining a mapping point.

19. The method of exchanging color information as defined in Claim 7, wherein mapping between surface control points includes calculating a scaling coefficient so that a surface control point of the source device mapped by gravity mapping is mapped again to a surface control point of the output device, and weighing the scaling coefficient responsive to a positional relation between an input point, a gravity control point and the surface control point for determining a mapping point.

20. The method of exchanging color information as defined in Claim 18 or Claim 19, wherein the weighing responsive to the positional relation between the gravity control point, the surface control point and the input point is given by an inverse of a distance between an input vector and the gravity control point.

21. The method of exchanging color information as defined in Claim 18 or Claim 19, wherein the weighing responsive to the positional relation between the gravity control point, the surface control point and the input point is given by a ratio of an inverse of a distance between an input vector and the gravity control point vs. an inverse of a distance between the input vector and the surface control point.

22. An information exchanging device for transmitting color

information from a source device to an output device, said exchanging device comprising:

(a) a color naming database for the source device, said database storing a color name as an answer by a viewer to a color stimulus rendered on the source device;

(b) a color naming database for the output device, said database storing a color name as an answer by the viewer to a color stimulus rendered on the output device;

(c) a color information normalizing section for the source device, said normalizing section retrieving the answer of the color name by the viewer from the database for the source device, and normalizing a distance between a gravity vector and an input color vector given by the source device to each color name;

(d) a gravity mapping controller for determining a mapping point based on the normalized distance so that gravity control points disposed in respective color spaces of the source device and the output device are mapped with each other;

(e) a dynamic range mapping controller for determining a mapping point based on the normalized distance so that surface control points disposed in respective color spaces of the source device and the output device are mapped with each other; and

(f) a target normalized distance searching section for searching the color space of the source device for a colorimetric value having a target normalized distance supplied from the dynamic range mapping controller.

23. A method of exchanging color information for transmitting color information from a source device to an output device, said method comprising

the steps of:

(a) rendering each test color rendered on the source device and the output device;

(b) watching the test color;

(c) naming the test color with a color name;

(d) grouping one of colorimetric values of the test color and a device drive level, both obtained in step (c), into each color name; and

(e) defining a normalized distance using a statistical process for each color name;

(f) producing a pre-mapped-color by mapping a color of the source device with changing lightness and chroma of the color; and

(g) re-mapping the pre-mapped-color using a weighing coefficient based on the normalized distance with changing lightness, chroma and hue of the pre-mapped-color.

24. A method of exchanging color information for transmitting color information from a source device to an output device, said method comprising the steps of:

(a) rendering each test color rendered on the source device and the output device;

(b) watching the test color;

(c) naming the test color with a color name;

(d) grouping one of colorimetric values of the test color and a device drive level, both obtained in step (c), into each color name; and

(e) defining a normalized distance using a statistical process for each color name;

(f) mapping a color of the source device using a weighing

coefficient based on the normalized distance with changing lightness, chroma and hue of the color.

25. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein the statistical process in step (e) includes calculating a gravity vector and a variance covariance matrix from one of the colorimetric value and the device drive level for each color name, and said method uses the gravity vector and the variance covariance matrix.

26. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein the weighing coefficient based on the normalized distance weighs a difference between control points disposed in a color space of the source device and a color space of the output device.

27. The method of exchanging color information as defined in Claim 26, wherein the control points are one of the colorimetric values and a gravity vector calculated from the device drive level.

28. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein the control points are disposed one of on gamut surfaces of the devices and near to the gamut surfaces.

29. The method of exchanging color information as defined in Claim 26, wherein a part of the control points are one of the colorimetric values and a gravity vector calculated from the device drive level, and the other part of the control points are disposed one of on gamut surfaces of the devices and near to the gamut surfaces.

30. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein the control points disposed in a color space of the source device and a color space of the output device agree with each other in terms of colorimetric value.

31. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein the control points disposed in a color space of the source device and a color space of the output device agree with each other in terms of color appearance.

32. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein a part of the control point disposed in a color space of the source device agree with a part of the control point disposed in a color space of the output device in terms of colorimetric value, and the other part of the control point disposed in the color space of the source device agree with the other part of the control point disposed in the color space of the output device interms of color appearance.

33. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein a colorimetric distance between control points disposed in a color space of the source device and in a color space of the output device is minimized within a color reproduction range of the source and output devices.

34. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein difference in color appearances between a control points disposed in a color space of the source device and in a color space of the output

device is minimized within a color reproduction range of the source and output devices.

35. The method of exchanging color information as defined in Claim 23 or Claim 24, wherein a colorimetric distance between a part of control points disposed in a color space of the source device and a part of control point disposed in a color space of the output device is minimized within a color reproduction range of the source and output devices, and difference in color appearances between the other part of control points disposed in a color space of the source device and the other part of control points disposed in a color space of the output device is minimized within a color reproduction range of the source and output devices.

36. The method of exchanging color information as defined in Claim 31, 32, 34 or 35, wherein when a control point where color appearances agree with each other is found or a control point where difference in color appearance is minimized is found, a color between gamut cusps of the source device and the output device is rendered to a viewer, and a color specified by the viewer is used as the control point of the source device.

37. A method of exchanging color information for transmitting color information from a source device to an output device, said method comprising the steps of:

(a) rendering a color on the source device;

(b) grouping colorimetric values of the colors through color names answered by the viewer to each of the colors; and

(c) mapping a cusp of the source device to gamut surface of

the output device responsive to disperse of lightness component of colorimetric value data grouped or a size of standard deviation.

38. The method of exchanging color information as defined in Claim 23, 24, or 37, wherein the color name answered by the viewer is a categorical basic color.

39. The method of exchanging color information as defined in Claim 23, 24, or 37, wherein the color name answered by the viewer is a memorized color.

40. The method of exchanging color information as defined in Claim 23, 24, or 37, wherein the color name answered by the viewer is set by the viewer.

41. A method of exchanging color information for mapping a color of a source device to a color space of an output device, said method comprising the steps of:

(a) finding color lightness of a cusp of the source device, the cusp being mapped on output device's gamut surface which agrees with color hue of the source device;

(b) finding lightness of a mapping point mapped between a lightness axis of the source device and that of the output device;

(c) weighing the cusp lightness found in step (a) and the lightness of the mapping point found in step (b) with a ratio of source device color chroma vs. maximum chroma among colors having hue and lightness of the source device, and determining lightness of the source device color to be mapped.

42. The method of exchanging color information as defined in Claim 41, wherein the mapping in step (b) is non-linear mapping, and the non-linear mapping is practiced by non-linear function through optimizing:

(a) a first two-dimensional coordinate point formed by lightness on a boundary between a black category and a gray category of the source device and lightness on the same boundary of the output device;

(b) a second two-dimensional coordinate point formed by lightness on a boundary between a white category and the gray category of the source device and lightness on the same boundary of the output device;

(c) a third two-dimensional coordinate point formed by minimum lightness of the source device and that of the output device; and

(d) a fourth two-dimensional coordinate point formed by maximum lightness of the source device and that of the output device.

43. A color information exchanging device comprising:

(a) a pre-mapping section for mapping every color rendered on a source device outside a gamut of an output device into the gamut of the output device with changing lightness and chroma of the color rendered on the source device;

(b) a color naming database for storing a gravity vector and a variance covariance matrix for each color, wherein the vector and the matrix are calculated from one of colorimetric values of a test color and device drive levels of both the source device and the output device, the values and the levels are grouped into each color, and the test color is obtained on both the source device and the output device through color naming by a viewer;

(c) a gamut shape control coefficient calculator for controlling

chroma so that a color, having maximum chroma, of the source device is mapped on gamut surface of the output device; and

(d) a main-mapping section for calculating a weighing coefficient based on a normalized distance defined for each color by using the gravity vector and the variance covariance matrix, and re-mapping the pre-mapped color using the weighing coefficient as well as the gamut shape control coefficient with changing lightness, chroma and hue of the pre-mapped color.

44. A color information exchanging device comprising:

(a) a color naming database for storing a gravity vector and a variance covariance matrix for each color, wherein the vector and the matrix are calculated from one of colorimetric value of a test color and device drive levels of both the source device and the output device, the values and the levels are grouped into each color, and the test color is obtained on both the source device and the output device through color naming by a viewer;

(b) a gamut shape control coefficient calculator for controlling chroma so that a color, having maximum chroma, of the source device is mapped on gamut surface of the output device; and

(c) a main-mapping section for calculating a weighing coefficient based on a normalized distance defined for each color by using the gravity vector and the variance covariance matrix, and re-mapping the color of the source device using the weighing coefficient as well as the gamut shape control coefficient with changing lightness, chroma and hue of the color of the source device.